# PROGRESS
# PRediction Of Geospace Radiation Environment and Solar wind parameterS

Work package 1

Management

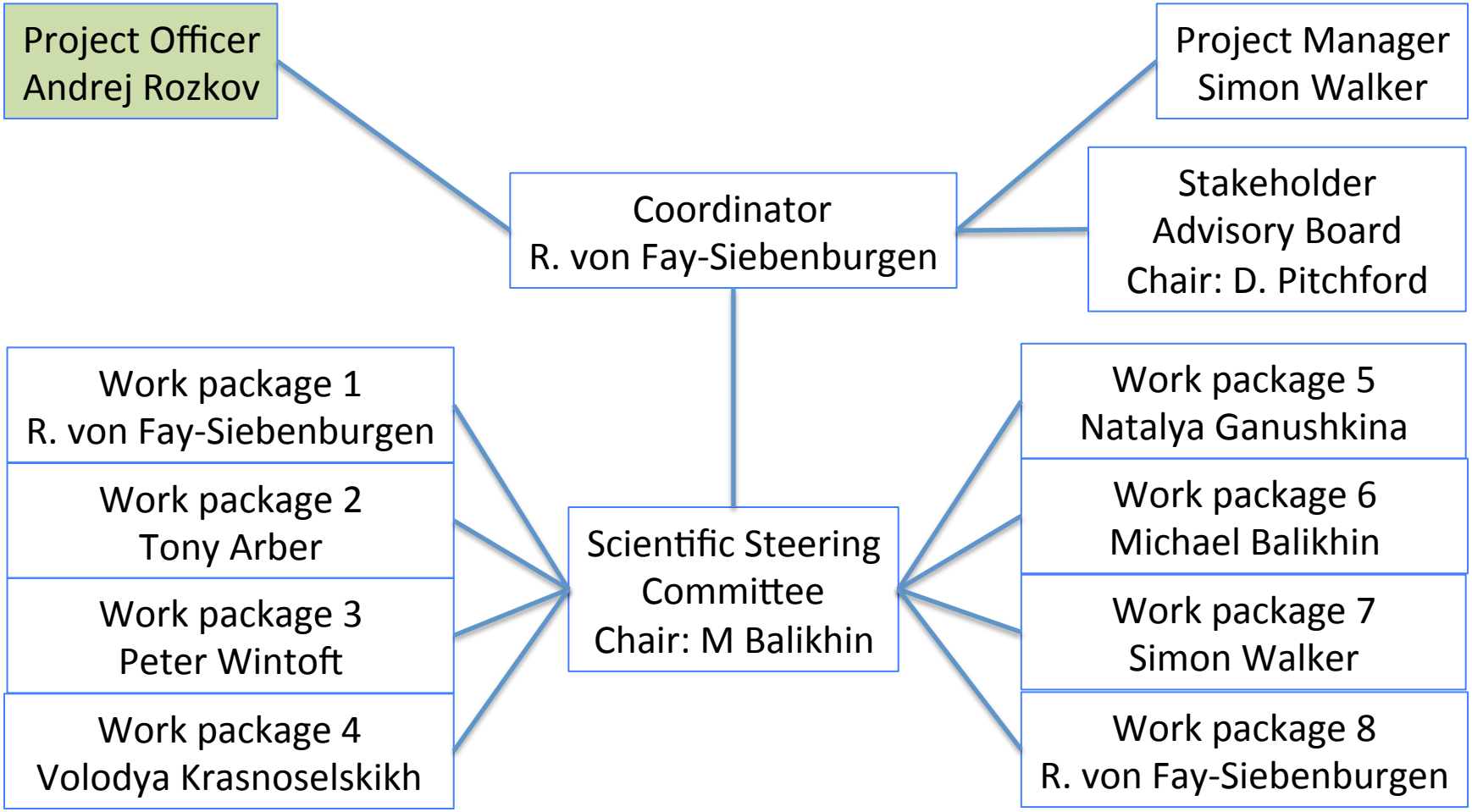
# Overview

- Status
- Management structure
- Deliverables/Milestones
- Periodic report
- Dissemination
- Risks
- Amendment to DoA
- WP highlights

# Status

- Project began January 1st, 2015
- In general project is proceeding to schedule defined in the DoA
  - Two discrepancies

# Management Structure



# SSC Membership

- **Coordinator** - R. von Fay-Siebenburgen
- **Manager** - S. Walker
- **WP Rep** - T. Arber, P. Wintoft, V. Krasnoselskikh, N. Ganushkina, M. Balikhin, Y. Shprits
- **SAB** – D. Pitchford

- **Chair** - M. Balikhin

# Stakeholder Advisory Board

The **SAB**, a body external to the project, takes a wider view of the project, advising the SSC and PC with respect to project direction and commercial interests. The main purpose of this body is to provide the commercial requirements that may be addressed by the project.

**Original membership**

- Project Coordinator/Manager
- Dave Pitchford – SES (Chair)
- David Jackson – UK Met Office
- M. Kuznetsova – NASA CCMC
- J. Volpp – ESOC
- D. Mourenas – CEA

**New members**

- Eamonn Daly ESA/ESTEC

# Meetings

- **Project Meetings**
  - 2 per year, face to face
  - Overview of work carried out and future plans
- **SSC**
  - 2 per year, face to face
  - Held in conjunction with Project meetings
- **SAB**
  - One per year
  - Provide industrial based feedback on products and direction
- **Review**
  - Tentative schedule M12 (T+F), M24 (T), M36(T+F)

# Deliverables

- Schedule defined by deliverables, reports, an milestones as listed in GA (table 1.3.2)

- Generally schedule has been kept, Deliverables submitted by the specified date or within a week or so
- One exception D3.3 – discussed later

- All deliverables available from
  - EC participant portal
  - Project web site (project only section)

# Deliverables list

## Project Deliverables

Date: 2016-01-06

Deliverables are listed by the date (month) in which they are due. Entries in green have been uploaded onto the participant portal and submitted, those in red are late for delivery, and orange should be delivered within the next 2 months.

D4.1 Report on data availability and list of chosen locations for each wave emission.
Participants: CNRS/LPC2E, USFD
Due: Feb, 2015 (Month 2)

D3.1 TN on existing models
Participants: IRF, USFD, SRI
Due: Mar, 2015 (Month 3)

D8.1 Project web site
Participants: USFD
Due: Mar, 2015 (Month 3)

D3.2 TN on data sets
Participants: IRF
Due: Jun, 2015 (Month 6)

D4.2 Report describing the database of emissions occurrences.
Participants: CNRS/LPC2E, USFD
Due: Jun, 2015 (Month 6)

D6.1 Journal paper, ready for submission, on a set of NARMAX models at GEO for various energy ranges.
Participants: USFD
Due: Jun, 2015 (Month 6)

D3.3 TN on model verification
Participants: IRF, USFD, SRI
Due: Sep, 2015 (Month 9)

D4.3 Journal paper ready for submission on the results of the Error Reduction Ratio analysis
Participants: USFD, CNRS/LPC2E
Due: Oct, 2015 (Month 10)

D2.1 Spherical geometry SWIFT code released and AWSoM time accurate tests completed
Participants: UW, UM
Due: Dec, 2015 (Month 12)

D5.1 Journal paper, ready for submission, on the solar wind and IMF driven model for low energy electrons in the plasma sheet.
Participants: FMI, USFD
Due: Dec, 2015 (Month 12)

D1.1 Minutes of first stakeholder meeting
Participants: USFD
Due: Feb, 2016 (Month 14)

D2.2 The coupling of the AWSoM and SWIFT codes
Participants: UW, UM
Due: Aug, 2016 (Month 20)

D3.4 TN on Kp and Dst models
Participants: IRF, USFD, SRI
Due: Dec, 2016 (Month 24)

D4.4 Final version of the statistical wave models
Participants: CNRS/LPC2E, USFD, SIST
Due: Dec, 2016 (Month 24)

D5.2 Journal paper, ready for submission, on the results of incorporating of diffusion coefficients from VERB into IMPTAM
Participants: FMI, SIST
Due: Dec, 2016 (Month 24)

D8.2 Exploitation and Dissemination plan
Participants: USFD
Due: Dec, 2016 (Month 24)

# Milestones

First milestone
Minutes of first stakeholder meeting
Due end February 2016

# Risks

## Delays in deliveries (low)

- WPs were designed with some buffer in the schedule to offer reasonable flexibility.
- Current delay of D3.3 should not affect the future schedule of the project.

## Participant moves to a different institution (low)

- Participant at SkolTech moved to Warwick.
- This has not interrupted the schedule in the DoA.

# Periodic Reporting

- **Project periodic Report**
  - Covers periods months 1-12 and months 13-36
  - Reports need to be submitted within 60 days of end of reporting period

- **Periodic technical report**
  - Part A

  This is generated by the IT system based on information entered as part of the continuous reporting/periodic reporting processes.
  - Part B

  This is a narrative document outlining the work carried out by the beneficiaries.

- **Periodic financial report**
  - Individual certified financial statement for each beneficiary
  - Explanation of use of resources
  - Online

Access to project Periodic Reporting will be available soon.

# Changes to DoA

A change to the DoA is required

- Movement of participant (Y. Shprits) from SkolTech to Warwick
- SkolTech have requested that their role in the project be terminated fom January 1st, 2015

An amendment to the DoA is currently being generated to modify the DoA

- DoA Annex 1 Part B has been updated and is ready for uploading
- Financal information has been updated based on spending predictions orivided by SkolTech. These should be verified and the proper conversion to Euros applied.

# WP 2 highlights

**Objective 1.**
Develop a European numerical MHD based model that will enable the advanced forecast of solar wind parameters at L1 (WP2). This will give a direct simulation connection between observed photospheric drivers and solar wind parameters at L1.

**Progress**
Convert the Cartesian geometry Lagrangian-remap code Lare3d to spherical geometry and release through a source control management system. The new code is called SWIFT.
In parallel to this to extend the AWSoM code to be able to run time-accurate and predictive by solving along selected field lines in the lower atmosphere.
Details of these activities have been reported in deliverable D2.1.

# WP 3 highlights

**Objective 2.** Use state of the art system science methodologies to develop new forecasting tools for geomagnetic indices and to assess the prediction efficiency of these new tools alongside those currently available to identify the most reliable techniques to predict the geomagnetic state of the magnetosphere, as expressed by geomagnetic indices, in relation to the solar wind input conditions (WP3).

**Progress**

A survey of existing operational models forecasting Kp, Dst, and AE has been carried out to determine the current availability of models. The results are in deliverable D3.1.

PROGRESS aims to develop a number of different models for the geomagnetic indices, based on different methodologies. Specific parameters have been identified and collect for use within the project. Details of the data sets are documented in deliverable D3.2.

Key problems associated with the models include their validation and verification, and determination of the predictive efficiency. A survey on the methodologies is being compiled. The results will be contained in deliverable D3.3.

# WP 4 highlights

**Objective 3.**
Construct a new set of statistical wave models. These novel wave models will lead to more realistic tensors of diffusion coefficients that are critical for physics based models of the radiation.

**Progress**
Data from THEMIS and Cluster were analysed to estimate the grid to be used for the spatio-temporal modeling of the magnetic field wave amplitudes using the Error Reduction Ratio methodology. The results were reported in deliverable D4.1.

A set of databases containing the wave amplitudes and location for three types of wave emission commonly observed in the inner magnetosphere (chorus, hiss, and magnetosonic) were created for the satellites Cluster 4, and THEMIS A, D, and E. The sources and contents of the databases are described in D4.2.

# WP 4 highlights

**Objective 3.**
Construct a new set of statistical wave models. These novel wave models will lead to more realistic tensors of diffusion coefficients that are critical for physics based models of the radiation.

**Progress (continued)**

The results presented in this study show that while the AE and Dst index control the largest proportion of the emissions variance, the solar wind parameters also have a significant contribution to the emissions variance according to the ERR analysis.

The statistical wave models that have previously been employed within numerical codes also have no definitive answer for the lag of the geomagnetic indices that should be used to organise models. The results from the ERR analysis have identified the significant lags to use for both geomagnetic indices and solar wind parameters.

# WP 5 highlights

**Objective 4.**
Incorporate forecasting capabilities into the physics based numerical model for low energy electrons IMPTAM that currently is able to provide a now-cast only.

**Progress**
A new empirical model for boundary conditions for low energy electrons at L=6-11 dependent on solar wind and IMF parameters is now constructed based on the extensive analysis of THEMIS ESA (eV-30 keV) and SST (25 keV –10 MeV) data during 2007-2013.

# WP 6 highlights

**Objective 5.** Develop a novel, reliable, and accurate forecast of the radiation environment in the region of radiation belts exploiting the fusion between data based models for high energy fluxes at geostationary orbit SNB$^3$GEO, IMPTAM, the most advanced model for high energy electrons in the radiation belts – VERB, and state of the art data assimilation methodology.

**Progress**

The current set of NARMAX flux prediction models operated by USFD has been extended to cover all energies measured by the GOES 13 Energetic Particle Sensor (EPS) instrument. The results and stability of the model are still under long-term evaluation prior to making them live. These results were reported in deliverable 6.1.

In order to forecast changes in the electron fluxes at all energies over the whole of the radiation belt/inner magnetosphere region The flux prediction models (mentioned above) are being coupled to VERB, a numerical simulation code to model the dynamics of the radiation belt region. An initial coupling of the models has been carried out and the results reported during European Space Weather Week.